Dynamics of Confined Membranes

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Lipid membranes have attracted much attention in the past decades, both for their unique physical properties, and for their wide biological relevance. For example, membranes are the main ingredient of cell walls, and stacks of lipid membranes play an important role as protective coatings in biolubrication systems, and in the stratum corneum. Usually these biological systems are crowded, and membranes are confined between other membranes, or between other biological substrates.

We discuss the role of confinement on the dynamics of lipid membranes by studying the adhesion of a membrane between two flat walls within a hydrodynamic model. Using a two-dimensional model, we find frozen states with finite-size adhesion patches, and an order-disorder transition controlled by the permeability of the walls[1,3].

Then, we discuss the influence of various extrernal forces which may restore the coarsening of adhesion patches[4], i.e. their perpetual increase in size triggered by merging of neighboring patches. First, we find that there is a finite membrane tension above which coarsening is restored. However, this tension is larger than the typical values deducted from experiments. Second, we show that a finite asymmetry in the adhesion potential, although irrelevant for impermeable walls, is able to eliminate the frozen states when the walls are permeable. Finally, adding noise to the model, we recover coarsening with exponents controlled by the wall permeability.

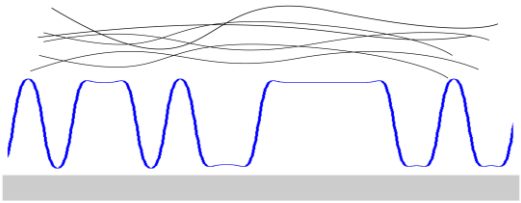

Figure : Schematic of a membrane confined between two biological substrates

[1] T. Le Goff, P. Politi, and O. Pierre-Louis, *Frozen states and order-disorder transition in the dynamics of confined membranes*, Phys Rev E 90 032114 (2014) .

[2] T. Le Goff, P. Politi, and O. Pierre-Louis, submitted (2015) .

[3] T. Le Goff, O. Pierre-Louis, P. Politi, submitted (2015) .